



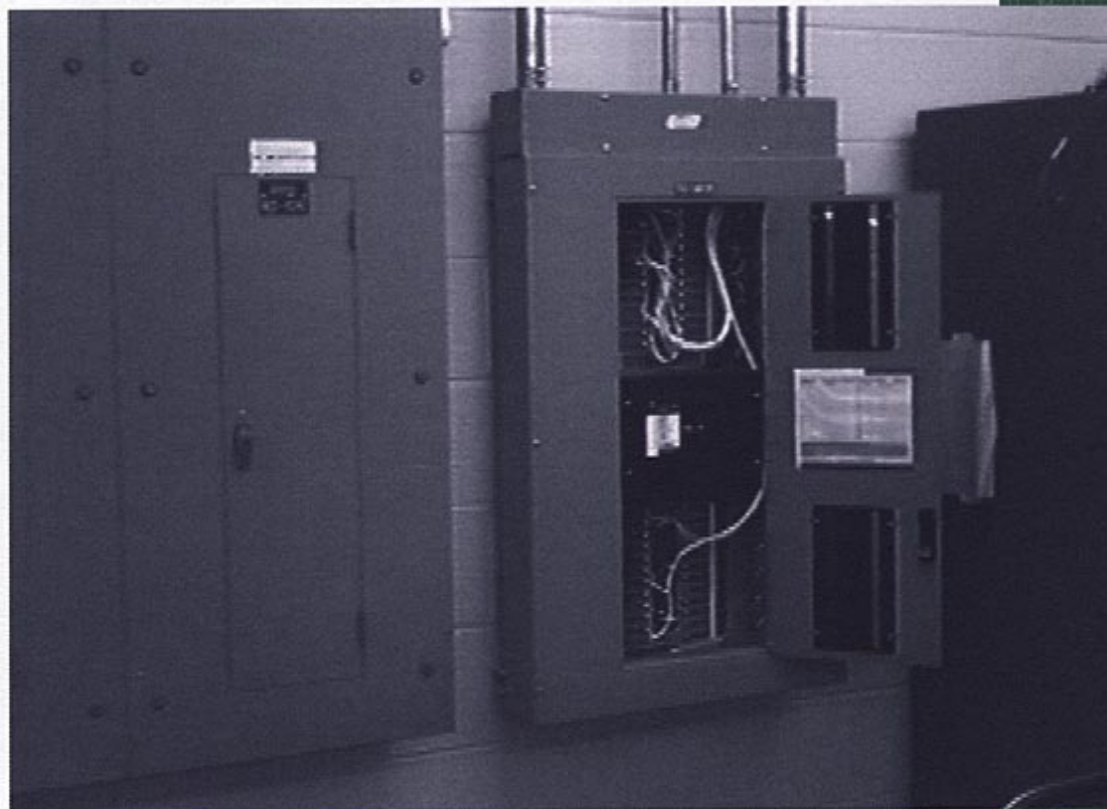
United States  
Environmental Protection  
Agency

Air and Radiation  
(6202j)

EPA 430-F-96-058  
October 1996

# APPLICATION PROFILE

## *Scheduling Controls*



Westinghouse  
Process  
Control  
Division

***Energy Manager:***

Bernie Meyers

***Contractor:***

In-House

Pittsburgh, Pennsylvania

### PROJECT RESULTS

Energy Savings	49%
Installed Cost	\$46,000
Simple Payback	0.7 years
Annual kWh Savings	1,135,500 kWh
Pollution Prevented	
CO <sub>2</sub>	1,816,800 lbs/yr
SO <sub>2</sub>	20,500 lbs/yr
NO <sub>x</sub>	6,500 lbs/yr

### TYPICAL APPLICATIONS

- Factories
- Offices
- Stores
- Warehouses
- Schools



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# SCHEDULING CONTROLS

## *Reducing Energy Waste Through Scheduled Lighting Operation*

### MANUFACTURERS OF SCHEDULING CONTROLS

- Advanced Control Technologies
- General Electric
- Holophane
- Honeywell
- Lithonia
- Lutron
- Microlite
- PLC Multipoint
- Powerline Communications
- Tork

Call the Green Lights Hotline at 1-888-STAR-YES for addresses and phone numbers of Green Lights Allies.

When lighting systems continue operating into the night, long after the staff has gone home, energy dollars are wasted. But this waste can be cost-effectively eliminated by installing controls that turn off the lights according to a preset schedule. Depending on the number of circuits to be controlled, lighting loads can be scheduled using either electronic time clocks or centralized lighting control systems.

**Electronic Time Clocks.** Electronic time clocks are relatively simple scheduling controls. Although they are more expensive than the older-technology mechanical time clocks, electronic time clocks provide up to 365-day scheduling flexibility and can be programmed to adjust for daylight-savings time and leap-years. Typical applications include small-business retail lighting and common-area lighting in apartments and small office buildings. Some time clocks are specifically designed to control outdoor lighting loads — such as lighting billboards and parking lots — by making daily adjustments in sunrise and sunset times according to predictable astronomic patterns.

**Centralized Lighting Control Systems.** Usually included as part of a building's energy management system (EMS), a centralized lighting control system provides essentially the same load scheduling functions as an electronic time clock, but on a larger scale. In addition, centralized systems can perform more sophisticated functions—including dimming and load management—if proper software and lighting equipment are installed. Typically located near the lighting circuit panel, centralized lighting control systems usually consist of a series of relays that switch individual lighting circuits based on low-voltage "on/off" switching signals received from a programmable scheduling microprocessor.

### Benefits

- Scheduling controls can be extremely cost-effective, particularly when the system controls relatively large electrical loads, or when equipment is typically left on overnight or on weekends.
- Some scheduling systems can maintain records of lighting system operation.
- Energy management systems can be used to schedule other non-lighting loads, including air handlers, rooftop units, pumps, chillers, and boilers.

### Issues

- When occupants remain in the space beyond the scheduled lighting period, a shutoff warning and override controls must be provided:
  - Local switches can communicate with the relay panel via low-voltage wiring or powerline carrier signals. Alternatively, simple latching switches can be used to manually restore power to a circuit after the system has switched it off.
  - In some systems, users can override the system schedule based on inputs entered on their touch-tone telephone.
- Electric rates that are based on the time of use are typically lower during the overnight period. Base your investment decisions on the cost of electricity when the savings occur.
- Unlike occupancy sensors, scheduling systems do not have the flexibility to eliminate wasted energy consumption during normal business hours. However, scheduling systems can be more cost-effective than sensors for eliminating over-

# CASE STUDY



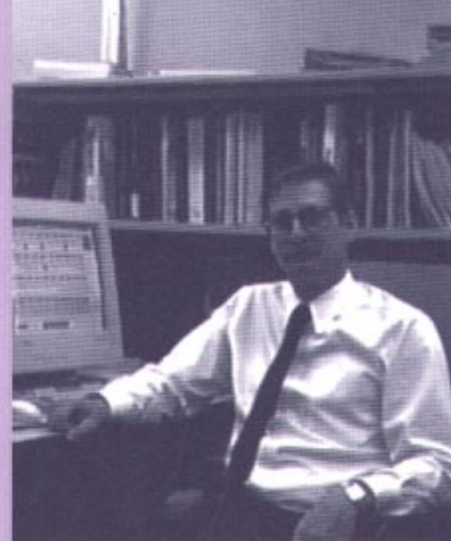
## Westinghouse Process Control Division

Bernie Meyers discovered that their manual light-switching strategy in the Process Control facility was costing Westinghouse over \$68,000 per year in wasted energy dollars. By installing simple lighting monitoring equipment, Bernie found that the lights were routinely operated an average of 22 hours per day — 365 days per year — even though the building was occupied only 16 hours per day, five days per week. That's when he knew that scheduling controls would be an excellent investment.

After installing a scheduling system in their 282,000 square foot facility, the lights have been programmed to automatically turn on at 6:00 am in the manufacturing areas and at 7:00 am in the office areas. When the cleaning crew begins their work at 4:00 pm, the lights in the manufacturing areas

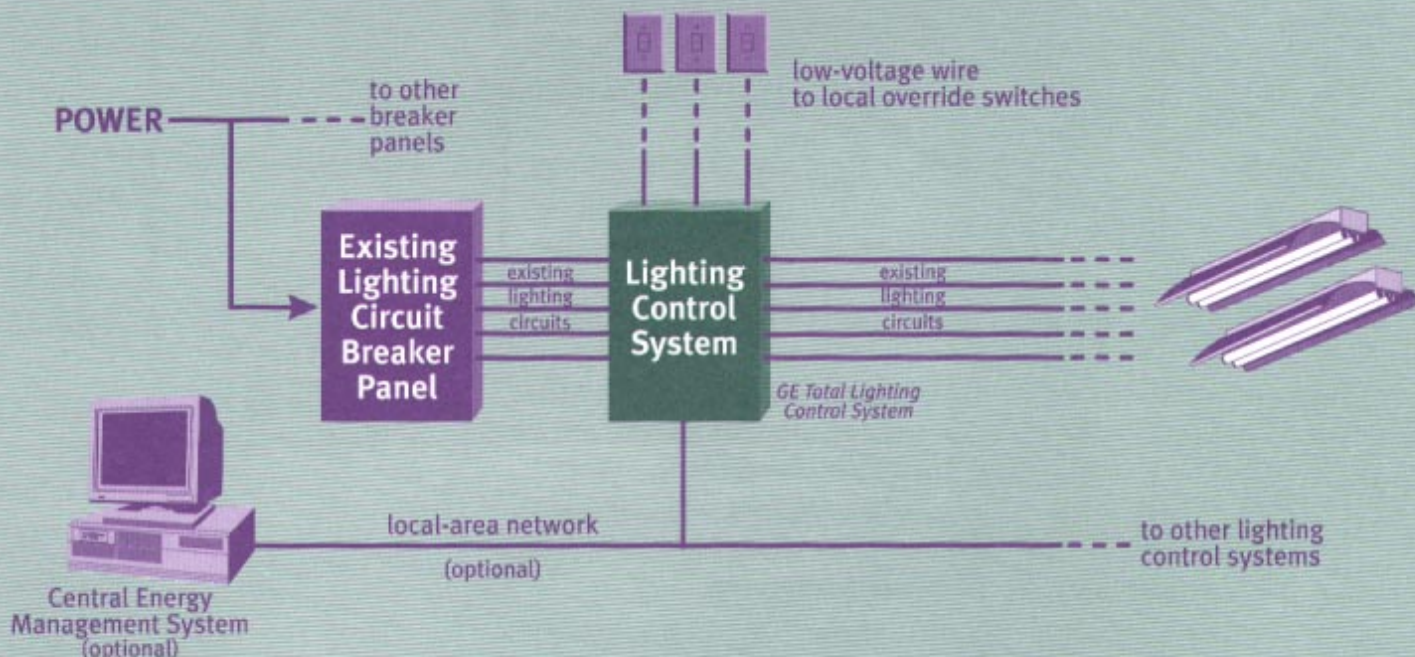
automatically switch to a half-light setting by turning off one of the dual circuits in each zone. As the cleaning crew works through the building, the lights in the first half of the building are turned off at 8:00 pm, and the remaining lights are turned off by the system at 10:00 pm. The lights are not scheduled to turn on during the weekends.

If occupants need to work during non-scheduled lighting periods, approximately 90 local override switches have been installed for users to activate as needed. Each time the override switch is pressed, an additional two hours of lighting is provided. Five minutes before the system is scheduled to turn off the lights, a noticeable flicker is provided, allowing the occupants time to press their local override button for additional two-hour lighting periods as needed.



*“We kept the system as simple as possible. The workers immediately adapted to using the override controls... no complaints!”*

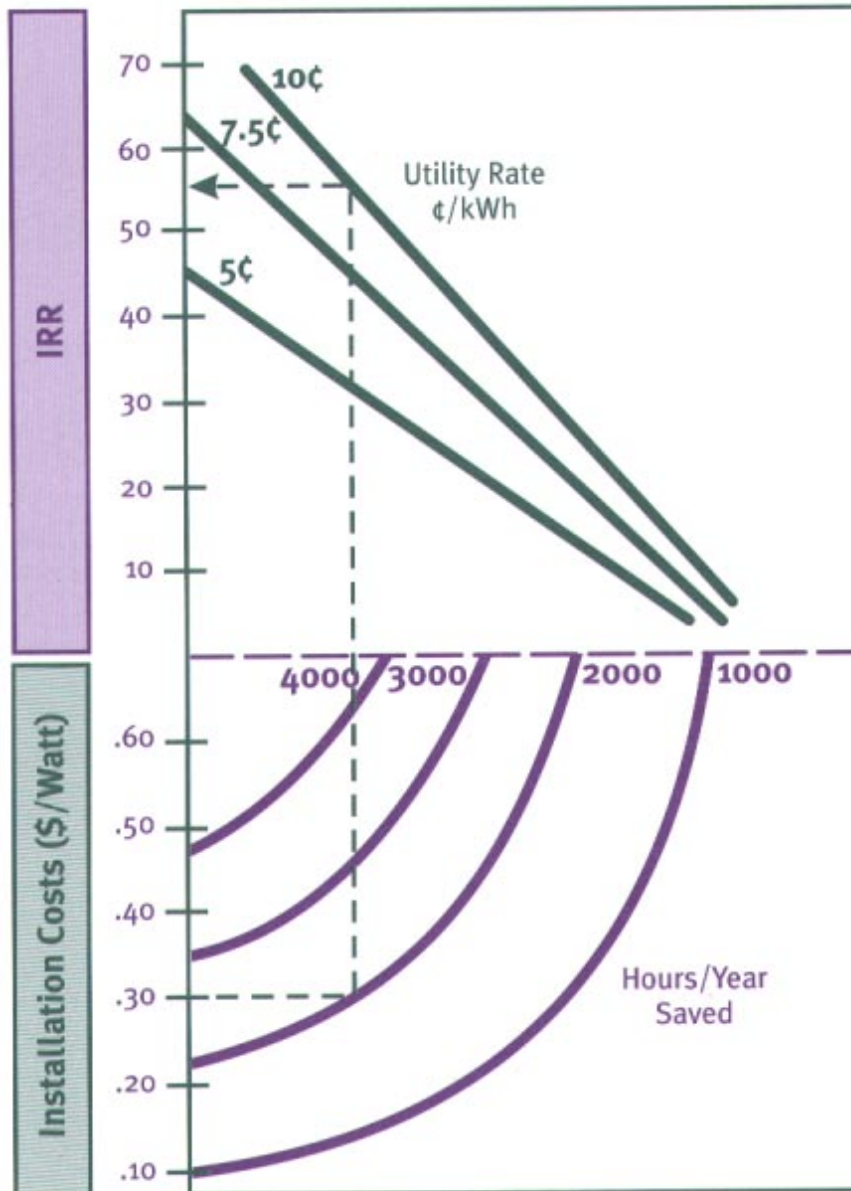
**-Bernie Meyers  
Energy Manager**



At each of 12 circuit breaker panels, Westinghouse installed a lighting control system. Based on inputs from their energy management system (EMS), groups of circuits are switched off. The schedule can be programmed directly inside the lighting control system or via any computer with access to the local-area network. Override switches are hardwired from the lighting control systems to user area locations.

# WILL IT WORK FOR YOU?

## COST ANALYSIS FOR SCHEDULING CONTROLS



Use this graph to estimate the cost-effectiveness of a scheduling system in your facility.

1. Determine your installed cost of the scheduling system per watt controlled, and mark this point on the graph. For example, a \$30,000 installed cost for controlling a 100,000-watt (100 kW) lighting load would be \$0.30/watt.
2. Draw a horizontal line from this point until it intersects the curve that represents the number of hours per year saved by the scheduling system. For our example, the system will save about 2,000 hours per year.
3. Draw a vertical line from this point until it intersects the line that represents your average electricity rate. In our example, the electricity rate is 10 cents per kilowatt-hour.
4. Draw a horizontal line from this point until it intersects the vertical axis that measures the internal rate of return. Our sample upgrade earns an after-tax internal rate of return of 54 percent.

The Green Lights Program offers 2-day Lighting Upgrade Workshops, Application Profile brochures, and other technical support services to assist program participants in applying cost-saving lighting strategies. For more information, call the Green Lights Hotline at 1-888-STAR-YES.

## Graph Assumptions

- Post-tax analysis: marginal income tax rate of 30 percent.
- 3 percent inflation for energy and maintenance costs
- No demand savings assumed. Depending on when the lights are switched, savings in peak demand charges can be significant. Contact your utility representative.
- No rebates assumed.
- IRR calculations based on 15-year cash flow projection